

Chapter II

THE CANAL ERA

TRANSPORTATION REQUIREMENTS

From the first days of the Republic Americans recognized that the transportation facilities of the colonial era no longer sufficed. The Revolution disclosed the isolation of the colonies from one another and the difficulties of moving men, military supplies, and goods up and down the seaboard. Roads were few and poor, all but the smallest rivers had to be ferried, and British warships menaced the customary traffic of coastal sailers. Thoughts turned inevitably to inland water connections. During and after the Revolution an unprecedented number of Americans surged westward. New settlements sprang up beyond the fall line, creating incentives to extend navigability farther inland by constructing passages around the falls. The growth in inland population also promoted the establishment of cities near the head of tidewater to provide transfer facilities for the trade on the upper rivers. Royal edicts such as the Proclamation of 1763 no longer restricted the flow of settlers into the more distant regions beyond the Appalachians. The number of people living west of the divide increased from a few thousand when the war began to 120,000 by 1790, laying the foundation for the states of Tennessee and Kentucky. These new westerners also needed access to markets.

Wars in Europe, which lasted almost without respite from 1793 to 1815, intensified the need for better transportation. The wars forced the belligerents to remove mercantilist restrictions on foreign trade with their colonies, threw the commerce of the world largely into American bottoms, and created an enormous demand for American foodstuffs and other supplies. Flour nearly doubled in price, sending a tide of migration into new grain-growing regions of western New York, western Pennsylvania, and still more remote areas along the Ohio River and the shores of Lake Erie. The cost of long overland hauls, however, placed many newly settled regions beyond the range of profitable use. Western Virginia, Tennessee, Kentucky, and Ohio could reach markets by way of the Mississippi River, but with New Orleans for some years in Spanish hands this was a politically uncertain avenue. For even more years the distances involved, time consumed, primitiveness of transport, and chance availability of ships at New Orleans--made this route an economically marginal one. In the lower South the cotton industry arose at this same time, stimulated by an increasing demand for the fiber in Europe and Whitney's invention of the cotton gin in 1792, which cheapened production to a fifth of its

former cost. Populations spread westward into upland sections suitable for cotton culture, adding to the pressures for better connections with the ocean highway.

A NATIONAL SYSTEM

The pressures for improved transportation facilities were not only economic and military, but also political. Improved communications would help tie together a still fragile new union, especially if they ended the isolation of the West. How to keep regions without an outlet for their produce except by way of New Orleans or the St. Lawrence loyal to the United States was for some years a matter of serious national concern. In 1808 considerations of commerce, defense, and political integrity led Secretary of the Treasury Albert Gallatin to prepare at the request of the Senate a comprehensive plan for tying the new nation together with government-sponsored roads and canals. Gallatin's great achievement was not to offer much that was new in the way of specific plans, but to combine many local improvement schemes then being urged or already undertaken into a coherent national system to be constructed under the aegis of the federal government.

To improve communications between the northern and southern states, Gallatin proposed the construction of canals across four "necks" of land between Boston Bay and Albemarle Sound, North Carolina, which would open an almost continuous natural "tide water inland navigation" from Massachusetts to Georgia. To this should be added "a great turnpike extending from Maine to Georgia passing through all the principal seaports." To bring the settlers beyond the mountains into easy communication with the East, the Secretary recommended the construction of roads over the Appalachian divide to connect the Susquehanna or the Juniata River to the Allegheny, the Potomac to the Monongahela, the James to the Kanawha, and the Santee or the Savannah to the Tennessee. He further recommended that the navigation of the eastern rivers of these four great land and water routes be improved, principally by constructing canals around falls. To open communication between the East and the Great Lakes, where advantage could be taken of a natural gateway through the mountains, Gallatin advised the construction of canals to connect the Hudson River with Lake Champlain, the Hudson River with Lake Ontario, and Lake Ontario with Lake Erie around Niagara Falls.

Because such "internal improvements" would unite the nation, improve its defense, and advance the economy, Gallatin proposed that the federal government either do the work itself or subsidize private companies. He considered the projects of such obvious value that the state involved would readily consent.

President Jefferson, however, always cautious about federal authority intruding upon the states, proposed an amendment to the Constitution that would "remove every impediment" to the great national plan.¹ But events interfered. Foreign difficulties leading to the War of 1812 gripped the nation's attention, and Gallatin's superb "Report on Roads and Canals" was shelved.

Belligerent interference with American shipping, American retaliatory restrictions on trade, and then the war itself served to accentuate the need for internal improvements. The embargo and the war diverted much of the capital employed in shipbuilding and commerce to manufacturing, and better roads and waterways were essential for the larger home markets desired. The British blockade reduced coastal shipping to a trickle, forcing American goods to move over inland routes. Coastal roads clogged with traffic, wagons backed up for miles at river ferries, and teams took weeks and even months to go from Boston, New York, or Philadelphia to Charleston. In some localities serious shortages of goods normally carried by sea pushed prices to new heights. Rice cost three times as much in New York as in Charleston; flour cost three times as much in Boston as in Richmond. The absence of good roads and dependable water communications also helped to frustrate American military campaigns on the northern and western frontiers.²

With these experiences in mind, President Madison in 1815 urged upon Congress "the great importance of establishing throughout our country the roads and canals which can best be executed under national authority." As had Jefferson, Madison suggested that any defect of that authority could be remedied by constitutional amendment.³ Representative John C. Calhoun of South Carolina promptly sponsored the so-called "Bonus Bill," which provided for a national system of internal improvements funded by monies due the government from the newly chartered second Bank of the United States. A strong nationalist at this point, Calhoun viewed internal improvements as a broad national question. But the debate and vote in Congress revealed that many of his colleagues were more concerned with state and sectional self-interest. New England, whose roads were relatively good, was almost solidly opposed. The measure, she feared, would increase an already serious drain of her people to the West and would promote the commerce of New York, Philadelphia, or Baltimore to the disadvantage of Boston. The South, which was well supplied with navigable rivers but had the poorest roads in the country, was largely opposed because she believed that other sections would benefit more than herself. The middle states of Delaware, Maryland, and New Jersey, apparently with similar thoughts, voted two to one against the measure. The West, badly needing internal improvements,

strongly approved, but local jealousies nevertheless produced some opposition. Only New York and Pennsylvania gave almost unanimous support. Both had promising routes to the West through their territories, New York hoped for federal aid in building the Erie Canal, and Pennsylvania hoped to reach the South by way of a Chesapeake and Delaware Canal and to see Pittsburgh profit immeasurably by the opening of the Falls of the Ohio to navigation. Ultimately Calhoun's bill squeaked by, but President Madison, firm in his belief that a constitutional amendment was necessary, vetoed it.⁴

Internal improvements at federal expense nevertheless seemed assured. In 1819 Calhoun, now Secretary of War, elaborated at the request of the House of Representatives a program much like that put together by Gallatin. Ignoring the constitutional question, Calhoun stressed the defensive value of a "judicious" system of roads and canals. He also advocated the extensive use of Army Engineers in making surveys and plans. Army Engineers were already involved in the work of improving internal communications and were to become even more so in the next several years. In 1816 the War Department, acting on the assumption that England would have to be fought again at some future date, had created a Board of Engineers for Fortifications. Initially consisting of Colonel William McRee, Major Joseph G. Totten, Captain J.D. Elliot of the Navy, and Brigadier General Simon Bernard, a French military engineer employed under congressional authorization by President Madison to assist the Corps of Engineers, the board sought to create a comprehensive defensive system based on the armed services, fortifications, and interior land and water communications.

On essentially military assignments, Army Engineers identified transportation routes while making western explorations. They made navigational surveys of the nation's great inland lakes and rivers and of rivers and harbors along the Atlantic coast. They laid out military roads and occasionally other highways. State governments and private corporations, faced with a critical shortage of civil engineers, called on the War Department for engineering assistance in making canal surveys. The Engineer Department within the War Department ordered the Board of Engineers to formulate plans for breakwaters at the mouth of Delaware Bay, as called for by an act of Congress, and Congress directly turned to the Army Engineers to determine the most practicable means of improving the navigability of stretches of the Ohio and Mississippi rivers and to provide a plan for improving the entrance to the harbor of Presque Isle, Pennsylvania, on Lake Erie.⁵

President Monroe, while at first taking the strict constructionist attitude of his predecessors toward internal improvements, was by 1823 satisfying his constitutional scruples by holding that Congress could make appropriations for improvements of national benefit if control of the improvement companies remained within the states. He also recommended that the Corps of Engineers survey the route of a canal to be built by private enterprise connecting Chesapeake Bay with the Ohio River and the routes of several proposed canals to connect the Ohio with Lake Erie.⁶

With federal encouragement of internal improvements conspicuously on the increase, Congress on 30 April 1824 passed a General Survey Act authorizing the President to employ Army and civil engineers to make surveys, plans, and estimates of roads and canals of national importance. Its evident purpose was to lay the foundations for a program of appropriations for internal improvements, with federal subscription to the stocks of companies undertaking them. To implement the act President Monroe appointed a Board of Engineers for Internal Improvements consisting of General Bernard, Colonel Totten, and John L. Sullivan, a prominent civil engineer. Under the direction of the board, Army Engineers examined all the major land and water routes proposed by Gallatin and Calhoun, and many other routes as well. The board began formulating plans for great national arteries of transportation. But the scheme of Gallatin and Calhoun for a rational, integrated system of internal communications developed under federal leadership was never realized.

The vote on the General Survey Act had again ominously revealed that particularist interests were far stronger than nationalist concerns. Successive Congresses and chief executives approved federal grants to help build specific roads and canals, and the average annual appropriation for internal improvements increased with each administration through that of Andrew Jackson. But bitter state and sectional jealousies, constitutional arguments that often seemed forced and unreal, and extremes of partisan politics all served to thwart plans that looked to the broad national interest. Increasingly, the General Survey Act became merely a vehicle for providing engineering assistance to state and private agencies. Complaints against this practice and the pressure of other duties on Army Engineers finally resulted, in 1838, in repeal of the act. The tremendous task of developing transportation in America was thus left largely to the conflicting ambitions of state and private enterprise.⁷

EARLY CANAL CONSTRUCTION

Artificial waterways were the most favored mode of transportation. The construction of turnpikes beginning in the 1780s and by the 1820s greatly improved overland transportation. But roads were not economically feasible for hauling anything except the most compact and valuable goods. Bulky products like wheat and corn could not be transported at a profit beyond 100 miles at the most. Contemporaries calculated that four horses could pull a wagon weight of one ton 12 miles a day over an ordinary road and one-and-a-half tons 18 miles a day over a turnpike. Comparatively, four horses could draw a boatload of 100 tons 24 miles a day on a canal.

From the late eighteenth century, when canals began to prove their worth in England, forward-looking Americans like George Washington, Robert Morris, and Albert Gallatin had visualized major waterways penetrating deep into the American hinterland. It was easier to conceive great waterways, however, than to construct them. America's eastern terrain was not, like England's, one of gentle contours. The science of civil engineering in America was in its infancy, and would-be engineers learning as they went often committed costly errors. Excavating machinery still belonged to the future, and canals were formidable challenges in an age of hand tools, gun powder, wheelbarrows, and horse-drawn carts. Canals also required heavy expenditures, and large pools of venture capital did not yet exist in the United States. Even when a few early enterprises overcame these obstacles, they *were* such financial failures as to discourage further investments. It was not until construction on the epic Erie Canal was under way several years and seemingly conquering all difficulties that the Canal Era in the United States really began.

Prior to that time many canal companies were organized. Before the year 1793 eight states had incorporated a total of 30 companies, and between 1776 and 1823 New Hampshire alone chartered 20. Some companies intended to construct lengthy overland canals, but most planned to improve river navigation by building short canals around falls and rapids. Many soon abandoned their efforts. Before work began on the Erie, only about 100 miles of canal had been constructed, and few canals were more than 2 miles long.⁹

The Riverine Canals

Although the canals bypassing river falls were not long, they were often impressive engineering achievements. Some required more than a half-dozen locks to make their descents, and almost all needed one or more dams or wing dams to divert water into their locks and ditches.

Canal construction in New England began in 1792 on the Connecticut River at South Hadley, Massachusetts. Dropping 50 feet in two-and-a-quarter miles, the river at this point was impassable even for canoes. Undertaking a difficult task for the time, the canal company, the "Proprietors of the Locks and Canals on Connecticut River," in one place cut a gorge 300 feet long and 40 feet deep through solid rock. For about a decade the company used an "inclined plane" to raise and lower boats from one river level to the other. Employed here for the first time in America, this device was perhaps suggested by Dutch stockholders. It was a 230-foot-long stone and timber ramp upon which the boats rode on a carriage that was hauled up or eased down by chains connected to water wheels. In 1805 the company replaced the inclined plane with five locks.

Meantime, other companies constructed locks and dams at four falls farther up the river, making the Connecticut navigable for flatboats for more than 200 miles above its mouth. A difficult passage, however, still remained at Enfield Rapids about 11 miles above the head of sloop navigation at Hartford. A long canal was required, and the high estimated cost deterred investors. Shippers got through inconveniently by transferring their goods to smaller boats or by passing the rapids at times of high water. It was not until a threat to Hartford arose from a plan to divert the Connecticut Valley trade to New Haven by a canal from that city to a point on the river above the rapids that a company formed in 1824 succeeded in digging a canal around them. The company went to work in earnest in 1827, and the Enfield Canal, six miles long with three locks, opened in 1829.¹⁰

The Merrimack River, rising at the same height as the Connecticut but reaching the sea by a course only half as long, saw even more construction. In 1796, Newburyport interests built a canal around Pawtucket Falls at present Lowell, Massachusetts, to permit lumber to pass downriver to the shipyards at Newburyport and other towns on the lower Merrimack. Farther up the river, subsidiaries of the Middlesex Canal Company had by 1814 constructed, as part of the company's extensive navigation system, six more sets of locks and canals to bypass more than a dozen falls and rapids. The largest work was the Amoskeag Canal at present Manchester, New Hampshire. A mile long and equipped with several dams and nine locks, it overcame a descent in the river of 45 feet.¹¹

In Maine, the Kennebec River was navigable for 65 miles to Waterville, but no seaport lay at its mouth about 30 miles up the coast from Portland. In 1795 a short canal constructed between the Kennebec and Casco Bay along the line of the Stevens River allowed a more direct connection to that city's wharves.¹²

Canal construction improved navigation on other rivers down the Atlantic seaboard. The Susquehanna River and its tributaries provided water transportation for a huge area of interior Pennsylvania and southwestern New York, but for more than 40 miles above its entrance into Chesapeake Bay it was choked by rapids and falls. Between 1792 and 1798 a stock company dug a 1-mile canal around Conewago Falls, the worst obstacle, just below Columbia, Pennsylvania, and improved the river by sluices for some 17 miles farther down. Flatboats and arks could now come down the river more easily, but to get back up was still difficult and often impossible.

The Potomac Canal Company, organized in 1785 with George Washington as president, set out to open the Potomac River to Cumberland, Maryland, over 200 miles above tidewater and 300 miles from Chesapeake Bay, and to connect it by road to the Ohio River. By 1818 the company had constructed crude chutes without locks around the three upper falls of the Potomac, locked canals around the Great and Little falls above Georgetown, and locked canals to pass five falls on the branch Shenandoah River, bankrupting itself in the process. The work on the falls above Georgetown was both a remarkable piece of engineering and extremely expensive. At Great Falls, where the river descends 76 feet in little more than a half-mile, the eastern end of the canal and the last two of five locks were cut from solid rock. The 37-foot descent of Little Falls required four locks in a canal 2 miles long.

The James River Company, chartered in 1785 and reorganized as a state corporation in 1820, had a comparable plan of improving navigation on the James River and linking it by turnpike to the Kanawha River, a tributary of the Ohio. This project also owed its conception to Washington, who was the company's honorary president for a decade. The company constructed and later enlarged a canal around the falls above Richmond and built another canal where the river breaks through the Blue Ridge. It also completed the turnpike connecting the James and Kanawha rivers and sporadically made river navigation improvements. But it was still far from its goal of providing adequate transportation through to the West when, under the influence of Erie fever, it was again reorganized as a private company in 1835.¹⁵

The state of South Carolina also participated directly in improving river transportation, and for several years after establishing a Board of Public Works in 1819 invested heavily in building locks and canals at falls. By 1825 small boats could make a trip of more than 300 miles from Cambridge to Charleston by passing through three state-built canals on the Saluda River and another on the Congaree and then through the Santee and

Cooper Canal constructed earlier by private enterprise. South Carolina also constructed canals at two places on the Wateree River, a large tributary of the Santee flowing down from the north, opening the river to navigation for about 200 miles from Charleston.

In North Carolina, the Roanoke Navigation Company, chartered in 1812 to improve navigation on the Roanoke River, had by 1823 constructed nearly nine miles of canal around the falls near Weldon, where, within a few miles, the river drops 100 feet. The canal terminated at its lower end, however, at a basin at Weldon, 1,800 feet from the river. As the extension to the river entailed the construction of six more locks at considerable expense, nothing more was done for several years and goods on reaching this point had to be drayed and transshipped. Upon insistence by the state that the company accept its stock subscription--which the directors considered inadequate--and complete the waterway, the company resumed work in 1828 and the canal opened to through traffic in 1834. Shortly afterward the Roanoke River flooded, breaking the sides of the lower locks. Refusing to rebuild them, the company argued, as it had before, that produce could be carried from the basin to the river by land as easily as it could pass through the locks. Within a few years railroads drew away a large part of the trade that had formerly gone down the lower Roanoke, and the canal was no longer considered of importance to the commerce of the region.

Early Overland Canals

Only three major canals were constructed before the Erie Canal was pushed across New York State, but compared to that ditch, they, too, were small undertakings. The longest was the Middlesex Canal in Massachusetts. Started in 1793 and completed in 1803, it ran 27 miles from the Merrimack River above Pawtucket Falls to the Charles River near Boston Harbor. Initiating a competition between ports that was to be a prominent feature of the Canal Era, its proprietors planned to divert the traffic of the Merrimack, which carried much of the trade of New Hampshire, from Newburyport to their own city of Boston. Upon completion of the Merrimack River canals in 1814, canal boats with capacities of 30 tons could travel from Boston to Concord, New Hampshire. Smaller boats could continue farther up the river and up the tributary Pemigewasset River to Plymouth, 113 miles from the sea. Despite the canal's value to the territory it served, it was a financial failure from its first day of business to its last, 50 years later. Local conditions permitted competition from teamsters in carrying general goods, and when the growth of manufacturing created a demand for raw materials that

was favorable to the canal, railroads reached out to garner this trade and eventually diverted to their cars every ton of traffic formerly moving by water.¹⁷

The Santee and Cooper Canal of South Carolina, constructed between 1792 and 1800, was a 22-mile waterway cut between the two rivers to give the agricultural products of central South Carolina a better outlet to Charleston. The Santee and its tributaries drained the whole South Carolina uplands, but its entrance to the sea, some 50 miles northeast of Charleston, was choked by a swampy delta and a shallow bay. From there boats had to pass to Charleston inside a broken string of sea islands, by turn risking shoal water and open ocean. The first boat to make the less hazardous passage through the Santee and Cooper Canal, in July 1800, carried a cargo of salt from Charleston up the Cooper, Santee, and Congaree rivers some 200 miles to Columbia. Although it opened the interior of South Carolina to water transportation, the Santee and the Cooper Canal} like the Middlesex Canal, never made money. Construction was more costly than had been expected. Then the rise of the cotton industry in the uplands in place of cereal production soon ended all shipment of grain to the coast. Cotton, far lighter in weight and more precious in value, could better bear the cost of transportation by land, especially since transport on the rivers was plagued by frequent mishaps, low water, and delays. Railroads also began to compete for the upland traffic in the 1840s, and the canal was finally abandoned in 1858.¹⁸

The Dismal Swamp Canal, a 20-mile waterway between the Pasquotank River flowing into Albermarle Sound and the Elizabeth River of Virginia near Norfolk, was designed to give North Carolina a short and sheltered outlet to a deepwater port. Begun in 1793 it was the only segment of Gallatin's proposed intra-coastal waterway under construction when the Secretary wrote his report. For years, however, sporadic work produced little more than a muddy, shallow ditch which not even flatboats carrying shingles cut in the swamp could navigate until 1805. The first craft other than a shingle flat to travel its course was a 20-ton boat in 1814, and it was not until a year-and-a-half later that another such passage was recorded. The first vessel to make the trip completely loaded with North Carolina cotton, flour, tobacco, and hogs was a 35-ton schooner in 1823. In 1826 Congress directed the Army Engineers to make surveys and estimates for improving and enlarging the canal so that it might serve as part of a chain of canals contemplated along the Atlantic coast. To pay for the reconstruction Congress ultimately purchased \$200,000 worth of Dismal Swamp Canal Company stock. In 1829 barges carrying up to 92 tons, as well as sloops, schooners, and rafts, began plying the enlarged waterway. Traffic steadily increased, and the canal at last became a paying enterprise and an important part of the transportation system of eastern North Carolina.

THE INSPIRATION OF THE ERIE

In view of the record of canal construction, the building of the Erie Canal was an act of faith. Authorized by the New York legislature in 1817 and completed in 1825, "Clinton's Big Ditch" stretched 363 miles from Buffalo on Lake Erie to Albany on the Hudson. It was the longest canal in the world and the greatest construction job that Americans had ever undertaken. Its high cost of \$7 million was met, not by private investors, but by the state. Engineering problems were greater than any previously confronted in canal building, but the lack of professional engineers was overcome by the appointment of able, though untrained, people to plan and supervise construction. They devised ingenious arrangements of cables, pulleys, wheels, and gears for bringing down trees and uprooting stumps. Instead of the usual shovel and wheelbarrow, they used specially designed plows and scrapers for moving earth. Even before its completion, the Erie Canal was a phenomenal financial success as well as a transportation triumph. The middle section of the canal from Utica to Rome opened in 1819, and successive sections as they came into use quickly filled with traffic. Within seven years after the canal opened to through traffic, tolls brought in enough money to repay the whole cost of construction.²⁰

The Erie funneled much of the commerce of the West to New York City. The area through which it passed, much of it formerly unsettled wilderness, boomed with prosperity. Boston, Philadelphia, and Baltimore--New York's commercial rivals--felt that they too must find ways of tapping the western market, and the idea took hold that almost any region reached by a canal would so prosper as to merit the investment. The Erie's success provided the stimulus that finally got the great canal-building boom under way. The huge sums necessary for construction were supplied to a large extent either directly or indirectly through public aid. Congress made substantial contributions by granting public domain to canal companies in the West and by purchasing stock in the Chesapeake and Ohio, Chesapeake and Delaware, Dismal Swamp, and Louisville and Portland canal companies. It was the states, however, that made the major capital contributions. In some cases, as in New York and Pennsylvania, they directly owned and operated extensive canal systems. More often states purchased or guaranteed the stock of private companies, the heaviest investments being made by Pennsylvania, Virginia, and Maryland. Sometimes states permitted newly organized banks to invest a portion of their capital endowment in the stock of a canal company, as did Maine, or they granted canal companies themselves banking privileges, as did Rhode Island and New Jersey. The Middle Atlantic states granted valuable monopoly rights rather than financial assistance to the promoters of the so-called "anthracite canals." Municipalities, such as New Haven, Connecticut, and various banks also invested in canal companies.

NEW ENGLAND CANALS

Of the major canals of the eastern seaboard, three were constructed in New England. The Cumberland and Oxford Canal in Maine, chartered in 1820 and completed in 1827, connected Sebago Lake with Casco Bay near Portland. Although only 20 miles long, it was supplemented by lake and river navigation that reached another 30 miles inland, and for many years it was an important outlet for products of the southeastern corner of the state. More successful than other New England canals, it did not succumb to railroad competition until the 1870s.²²

The Blackstone Canal, constructed between 1824 and 1828, linked Worcester, Massachusetts, with Providence, Rhode Island, 45 miles away. Worcester was surrounded by good farming land, but the area had been slow in developing because of the heavy expense of hauling produce to the Boston market. Despite irregular service resulting from too much or too little water and from poor maintenance, the canal proved to be a considerable, if brief, boon to the area. Trade increased, villages sprang up, and mills and factories developed along its line. When a railroad from Worcester to Boston was completed in 1835, however, business declined rapidly, and when Worcester was connected by rail to Providence in 1847, traffic ceased entirely.²³

The longest and most costly, and also the least successful, of New England canals was the New Haven and Northampton, chartered in 1822 and after many difficulties opened in 1835. Connecting with the Connecticut River at Northampton, Massachusetts, some 40 miles above Hartford, it was designed to capture for New Haven the trade of the river's rich upper valley, as Enfield Rapids, when the project began, still hindered navigation to Hartford. Poorly constructed though costing well over a million dollars for its 78-mile course, constantly short of capital, repeatedly damaged by floods, and always short of water in dry seasons, it seldom carried enough traffic to cover expenses. In 1847 it was abandoned.²⁴

New England's construction of canals fell considerable short of its vision and schemes. An old plan of Boston merchants dating back to 1791 for a canal from the Charles River to the Connecticut River, "to take the trade from Hartford," was revived on grander lines. One proposed route would run the canal through Worcester, stopping the drainage of trade by the Blackstone Canal, connect with the Connecticut, taking that river's trade from both Hartford and New Haven, and continue across the Berkshire Mountains to the Hudson River near Albany, where it would divert to Boston much of the Erie trade going to New York. In 1825 the Massachusetts legislature ordered surveys,

and canal commissioners reported eloquently on the benefits of the enterprise. But the legislature, recognizing that costs would be huge and engineering difficulties almost insurmountable, turned its attention to railroads.²⁵

Canal promoters in Maine contemplated several large projects, which would direct state trade to the St. Lawrence River or to Boston, that never reached the survey stage. Ambitious canal schemes in New Hampshire and Vermont, however, progressed to the point where Army Engineers surveyed several routes under the authority of the General Survey Act. One route connected Rutland, Vermont, with the Champlain Canal, which the state of New York had built in conjunction with the Erie Canal to connect Lake Champlain to the Hudson River. The other routes, while consisting of numerous sections, each with its own state or private sponsor, would together have formed three great lines of navigation reaching across New England from Lake Champlain to the Atlantic, one terminating at Portland, another at Portsmouth, and the third at Concord on the Merrimack. Intersecting the principal rivers of the region--the Connecticut, the Merrimack, the Androscoggin, and the Kennebec, which the Army Engineers also surveyed with a view to improving navigation--the canals would have formed with the rivers a huge transportation grid serving five states. Railroads, however, quashed the projects even before the Engineers had time to complete their reports and designs.²⁷

One other canal proposed for New England was to have a future, though it had to wait nearly a century. This was a waterway that would eliminate the dangerous passage around Cape Cod and shorten the sailing distance to New York. In his "Report on Roads and Canals," Gallatin had proposed a route from Boston Harbor to Narragansett Bay along a course surveyed by the state of Massachusetts in 1806. In 1824-1825 the Army Engineers made another survey of this route, but they were more interested in a shorter one that cut across the base of the cape between Barnstable Bay and Buzzards Bay. Less than eight miles long, the route was traversed most of the way by rivers flowing north and south, with the ridge between them rising only about 30 feet above sea level and at one point only three-quarters of a mile wide. The Plymouth colonists had crossed here by boat and foot as early as 1623 to trade with the Narragansett Indians and later with the Dutch at New Amsterdam. By 1676 people were talking of cutting "a passage from the South Sea to the North." In 1697 and again in 1776 the General Court of Massachusetts appointed committees to investigate the feasibility of such a canal, but with no result. In 1791 the legislature ordered a third survey, and in 1818 a Boston company chartered that year made yet another. Plans and estimates for a canal, however, were not forthcoming until the Corps survey. Although there seemed to be

no doubt about the canal's practicability, no serious obstacles to construction, and no great costs involved, neither Congress, nor Massachusetts, nor private enterprise took any further action. The project languished until 1860, and then it was another 54 years-before the canal was finally built.²⁸

MIDDLE ATLANTIC CANALS

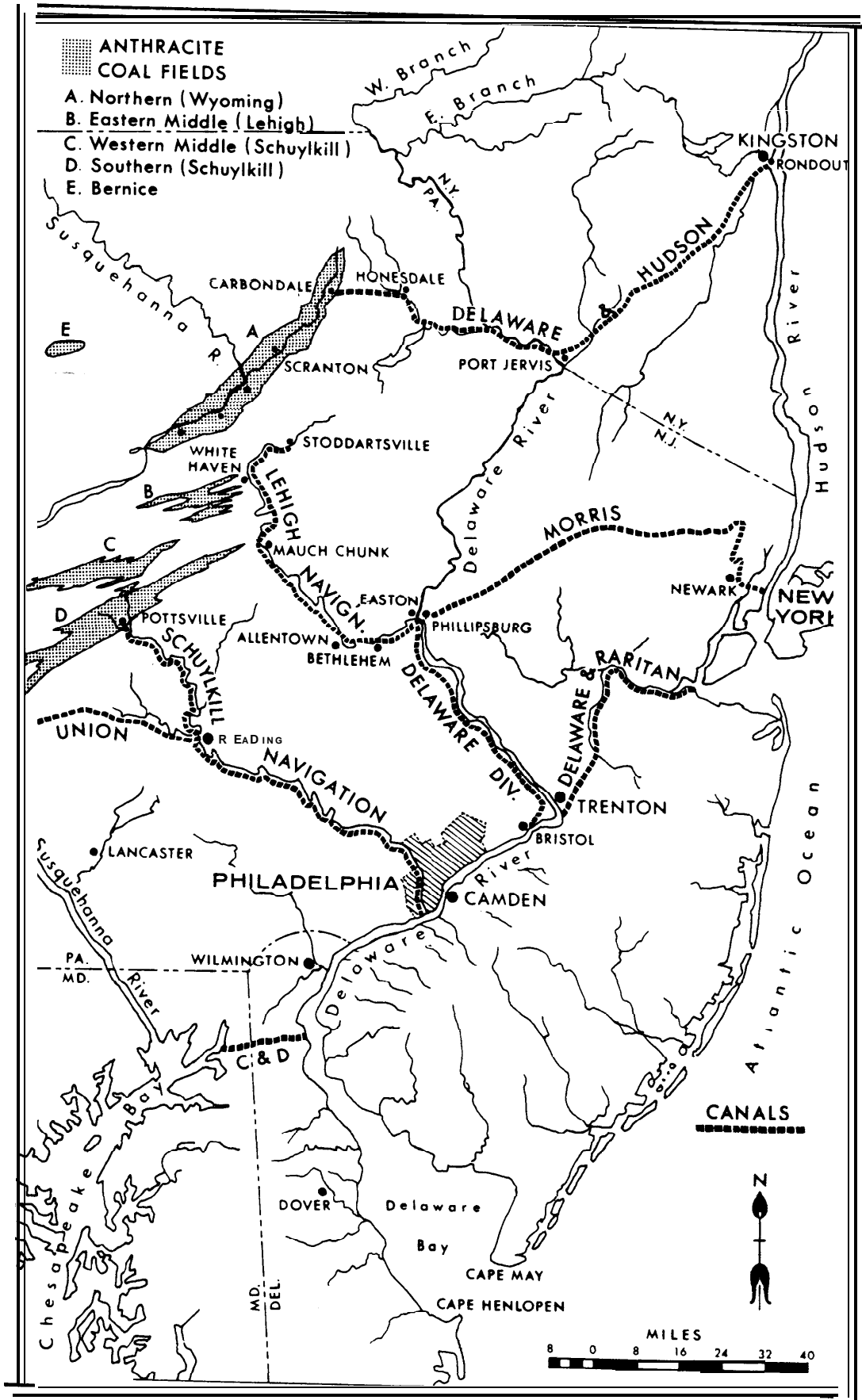
The Anthracite Canals

The Middle Atlantic states saw the greatest activity in canal building, with three distinguishable groups of waterways constructed. One complex, known as the "anthracite canals" was constructed to carry this new fuel from eastern Pennsylvania to New York and Philadelphia markets. The northernmost canal, the Delaware and Hudson, ran from Honesdale in northeastern Pennsylvania to the Delaware River, which it crossed by means of a dam and slackwater and later by a suspension aqueduct. The canal continued northeasterly across New York for a total of 108 miles to Rondout on the Hudson near Kingston. Started in 1825 and completed in 1828, the canal did a tremendous business making an increasingly popular fuel available to New York and New England cities. Originally a small waterway that could accommodate boats carrying only 25 or 30 tons, it was enlarged several times until boats of 140 tons capacity could be used. Enormously profitable, the canal company paid its investors good dividends for many years with the peak of its traffic not being reached until 1872.²⁹

The Lehigh Canal, completed in 1829 to provide another outlet for Pennsylvania anthracite, ran nearly 72 miles from White Haven through Mauch Chunk to Easton on the Delaware River. Replacing an inadequate system of transporting coal on the Lehigh River, the Lehigh Canal, although still depending in small part on slackwater navigation on the river, was a large, well-constructed waterway capable of floating boats of 100 tons. In its peak year, 1860, 2,000 barges ran its course, carrying more than a million-and-one-third tons of traffic.³⁰

At Easton, the Lehigh Canal fed into two other canals, one supplying anthracite to Philadelphia, the other to New York. The Delaware Division Canal, opened over its full length in 1832, paralleled the Delaware River for 60 miles south to Bristol, from where boats could navigate the river to Philadelphia. Built by the state of Pennsylvania, it was the only anthracite canal not under private management. In a mistaken effort to save money, it was constructed on a smaller scale than the Lehigh, with the result that cargoes of the larger Lehigh boats had to be trans-shipped at Easton to small craft. Nevertheless, the Delaware Division Canal did a large business and yielded good return on construction costs.

The Anthracite Canals



The Morris Canal, also connecting with the Lehigh at Easton, was intended not only to supply New York with coal, but to stimulate agriculture and manufacturing and revive the iron industry of northern New Jersey, which had flourished in colonial times. Winding through the hills of northern New Jersey to Newark Bay, the canal had to overcome an elevation of 914 feet. With the limited lift of locks in those days, the 200 to 300 locks required made the project prohibitively expensive. The canal's promoters, considered using inclined planes, but wanting reliable professional advice, called on Secretary of War Calhoun for assistance. General Bernard and Colonel Totten of the Army's Board of Engineers for Fortifications surveyed the route in 1823. They agreed that the idea was financially and technically practicable. The inclined planes, constructed wherever a long, steep hill had to be surmounted, were steam-powered cable railways on which the barges ascended or descended about 10 feet for every 100 feet of track. Twenty-three inclines took care of the greater part of the elevation, and only 23 locks were needed to cover the rest.

Construction on the canal began in 1825, and in 1831 the 90-mile connection between the Delaware River and Newark was completed. In 1836 the canal was extended another 12 miles across the Bayonne neck to Jersey City. Although a considerable engineering achievement, the Morris Canal, like the Delaware Division, was the victim of shortsighted planning. No doubt due in large degree to lack of funds, its locks could not accommodate boats of more than 25 tons, thus excluding the larger Lehigh barges. Hurting the profitability of the canal even more were the scandalous financial manipulations of its directors, who had been granted banking privileges. When bankruptcy hit in 1841, a new company took over the canal, enlarged it, and managed to keep it out of the red until after the Civil War. Despite its shortcomings, the canal carried a considerable tonnage of anthracite and contributed materially, as had been intended, to the economic development of northern New Jersey.³²

A fifth anthracite canal, the Delaware and Raritan, cut 44 miles across central New Jersey from Bordentown on the Delaware River to New Brunswick on the Raritan, which connected it to Perth Amboy. The location was one of the four "necks*" of land across which Gallatin had recommended the construction of canals in 1808. Completed in 1838, the canal was a large and well-constructed waterway that not only carried considerable Pennsylvania coal, but also much commerce of a more general nature. Despite handicaps of railroad ownership and irresponsible management, the canal was one of the most important in the country before the Civil War, and for a few years actually carried greater tonnage than did the Erie.³³

Canals of Broader Commercial Purpose

Three other Middle Atlantic canals built by private enterprise, while also important to the coal trade, were primarily carriers of general merchandise. One, the Chesapeake and Delaware Canal, provided an inland shortcut for shipping between the two great bays. At their heads the land distance between the bays narrows to less than 20 miles. Cutting a canal across this isthmus had been discussed since the Delaware Colony was in the hands of the Dutch. A route was surveyed as early as 1764, and construction repeatedly urged. Like the Delaware and Raritan, the proposed canal was a link in Gallatin's projected intracoastal waterway, and like the Morris Canal, it was surveyed in 1823 by Engineers Bernard and Totten, whose recommendations appear to have been decisive in determining the route that was adopted. When opened in 1829, the canal reduced the distance of water transportation between Philadelphia and Baltimore by more than 300 miles. Financial embarrassments plagued the canal in its early years, but by the 1840s it was carrying steadily increasing amounts of traffic that in 1872 reached a peak of a million-and-one-third tons. But the company never fully recovered from the financial disasters of its first decade, and until the federal government purchased its property and franchises in 1919, it was continually in debt. Ultimately the government transformed the waterway from a small barge canal into a ship canal as part of the Atlantic Intracoastal Waterway.³⁴

The Schuylkill Navigation and the Union Canal was a combined waterway designed to bring to Philadelphia the trade of interior Pennsylvania and southwestern New York reached by the Susquehanna River and its tributaries. The Schuylkill Navigation, which opened in 1825, consisted of 45 miles of slackwater and 63 miles of canals that extended the navigation of the Schuylkill River from Philadelphia to Port Carbon. The Union Canal, completed two years later, united the Schuylkill at Reading with the Susquehanna at Middletown, just south of Harrisburg. The 77-mile Union Canal, however, proved to be a bottleneck in the extensive system. Because of topographical difficulties and a shortage of water, the canal's dimensions limited traffic to boats of 25 tons, thereby excluding the larger barges of the Schuylkill and those of the Pennsylvania state canals soon built to the west. Enlarged in the early 1850s to give it the capacity of the state canals, the Union for a few years doubled its traffic, but the excessive costs of reconstruction together with increasing railroad competition led to declining profits by the end of the decade.³⁵

The Susquehanna and Tidewater Canal represented Baltimore's bid to garner the rich trade of the Susquehanna watershed. This could be done only if the navigability of the lower Susquehanna, with its 40-odd-miles of rapids and falls, were improved. In 1823 Army Engineer Captain Hartman Bathe, at the request of Maryland, surveyed a route along the river to circumvent these obstacles. It was not until 1840, however, that the Susquehanna and Tidewater Canal, reaching from Havre de Grace on Chesapeake Bay 45 miles up the river to clear navigation at Wrightsville, opened to traffic. It was a costly canal, about \$80,000 a mile, but its large locks were soon heavy with traffic, justifying the expense. Ironically, in view of the intentions of the canal's original-promoters, Susquehanna trade flowed not only to Baltimore but also, by taking advantage of the Chesapeake and Delaware Canal, to rival Philadelphia.³⁶

The Pennsylvania State Canals

The third group of canals in the Middle Atlantic region, and the most ambitious of all the artificial waterway projects, were the Pennsylvania state canals. As the Erie Canal neared completion, merchants of Philadelphia, fearing a heavy loss of western trade to New York, began to push for a waterway of their own to Pittsburgh on the Ohio. Opposition was not wanting. It came from wagoners and innkeepers on the turnpikes, from farsighted people who said that the still unproven railroad would be the better answer, from Pennsylvanians who would share in the canal's costs but not in its benefits, and from critics who insisted that the canal would cross such rugged and difficult terrain it could never compete successfully with the Erie. But canal fever carried the day. In 1826 Pennsylvania began the Main Line Canal.

But the state had to settle for a compromise between waterway and rail. The Union Canal, which already connected Philadelphia with the Susquehanna River, was too small to carry all the expected traffic. Moreover, Major John Wilson of the Army Engineers, who made a preliminary examination of the route at the request of the canal's promoters, advised that the area between Philadelphia and the Susquehanna was much more appropriate for a railroad than for a canal. Therefore the first section of the Main Line from Philadelphia to Columbia on the Susquehanna was a railroad, which for its first few years, was horse drawn. From Columbia a series of canals along the Susquehanna and Juniata rivers brought the Main Line to the backbone of the Allegheny Mountains near Hollidaysburg. The famous 36-mile Allegheny Portage Railroad surmounted the crest. On a series of ten inclined planes, the canal boats, which could be dismantled into sections, rode on cable cars up one side of the divide and down the other. Canals following the Conemaugh and Allegheny river valleys brought the Main Line the rest of the way to Pittsburgh.

Opened over its entire length in 1834, the Main Line was 30 miles longer than the Erie Canal and cost in excess of \$4 million more to build. The Erie took the Appalachians in flank, rising at its highest point only 650 feet above sea level. The Main Line had to take the mountains head on, crossing at an altitude of 2,322 feet. The Erie could travel its course with 84 locks; the Main Line needed 174. The Main Line did attract considerable business, but it never became a serious challenge to the Erie. The Portage Railroad bottlenecked traffic and the excessive lockage slowed passage further. Then at Columbia cargoes had to be transshipped to railroad cars or to boats small enough to slip through the Union Canal. In 1840 the last disadvantage was partially overcome with the completion of the Susquehanna and Tidewater Canal, which permitted large barges to continue on to Chesapeake Bay and to Philadelphia or to rival Baltimore. But traffic on the Main Line continued to be more costly and more time consuming than on the Erie.

Because of political pressures from sections of the state that wanted their own waterways, Pennsylvania built not only the Main Line but also a whole system of branch canals, whose total mileage by 1834 was almost double that of the through route to Pittsburgh. Sections of the state not yet satisfied, however, continued to force construction, until by 1842 Pennsylvania had 772 miles of canal built and another 162 miles building. Then the bubble of confidence burst. Most of the canals, suffering from high initial costs, slow movement of traffic, and strong railroad competition, were losing money; and the state was virtually bankrupt. In the 1850s Pennsylvania sold most of her canals to railroads and other private corporations.³⁷

SOUTHERN CANALS

The success of the Erie also gave new life to the South's schemes to share in the rich trade of the West. The dream of the old Potomac Company to connect the Potomac River with the Ohio was revived by the Chesapeake and Ohio Canal Company, organized in 1828. Taking a lesson as well as enthusiasm from the Erie, the company abandoned the system of short canals and river improvements constructed by the old company and substituted a permanent artificial waterway extending up the Potomac Valley. Receiving generous stock subscriptions from Virginia, Maryland, and the federal government, the company began work on the Potomac River section from Georgetown to Cumberland, 184 miles away at the base of the mountains. This barrier, even higher here than in Pennsylvania, was not to be crossed by tracks like the Main Line, or by road as the Potomac Company had planned, but would be surmounted by 246 locks and a 4-mile tunnel piercing the divide at 1,900 feet. This engineering challenge was never met. The waterway did not open to Cumberland until 1850, and

its \$11 million cost exceeded that of the Erie and Champlain canals combined. Disputes over rights of way, a cholera epidemic, political obstructionism> and continual labor, financial, and engineering problems had delayed construction and increased costs beyond the \$8 million estimate of the Corps of Engineers in 1826 that canal supporters had deemed preposterous. The canal's dimensions, however, were generous. Therefore despite competition from the Baltimore and Ohio Railroad, whose tracks paralleled most of its route, the waterway accommodated large barges and attracted considerable business, mostly transporting coal from around Cumberland. The canal continued in use into the twentieth century, but it never became a major transportation agency or a paying enterprise.

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The plan to connect the James River with the Kanawha was also revived. In 1835 the assets of the old James River Company were taken over by a private corporation under the name of the James River and Kanawha Company, with the state of Virginia holding three-fifths of the stock. Making the last attempt to unite the Atlantic with the West by water, the company displayed enormous optimism, for not only were the engineering problems substantial, but by 1835 the faith placed in waterways was already being transferred to railroads. Like the Chesapeake and Ohio Company, the James River and Kanawha Company made little use of the old river-improvement works and relied on slackwater navigation for only a small part of the route. And it too planned to pierce the mountains with a tunnel. Surveys made by Major William G. McNeill of the Army Engineers between 1826 and 1828 had found that it would be practicable to do so with a tunnel 2.6 miles long at an elevation of about 1,900 feet. Subsequent surveys did not change these plans. By 1840 the canal was completed 146 miles from Richmond to Lynchburg. From that date to 1856, as funds became available, it was extended about another 50 miles toward Covington. Then work was suspended for want of means to carry it further. As with the Chesapeake and Ohio, difficulties of construction were great and the cost, over \$10 million, exceeded expectations. Although the company never turned debts into profits, the canal traveled through relatively rich country and did a substantial business. In 1860, despite railroad competition, it was by far the largest freight carrier in Virginia.³⁹

Following the Civil War, the James River and Kanawha Company turned to Washington for succor, propagandizing the idea of a great central waterway from the Atlantic to the Mississippi. The moment was opportune, for there was growing resentment in the West over alleged exploitation by railroads. The National Board of Trade; national commercial conventions; and the states of Ohio, Iowa, and Kansas, claiming that railroads were not meeting the demands of the West for the cheap and abundant

transportation of bulky produce to the seaboard, petitioned Congress to construct the great "central water line." In 1870 Congress authorized the Corps of Engineers to make a new survey to the Ohio. Major William P. Craighill, who directed the survey, reported, as had Major McNeill over 40 years before, that a water route through the mountains was entirely practicable. In 1868 the canal company had surveyed a route through them at a lower elevation than originally planned, which would pierce the crest with a tunnel 9 miles long. Craighill found that the job could be done with a tunnel 7.8 miles long. He estimated the cost of constructing the uncompleted parts of the line and of enlarging the rest to admit boats carrying 280 tons at around \$50 million, an expense that he argued was warranted by the needs of the West for a cheap and certain commercial outlet to the Atlantic coast. "It has been supposed by some that the day of canals is past," he also commented. "Facts do not sustain this view When the circumstances are such that slowness of movement is permissible and the quantities to be moved large, the cheapness of the canal becomes obvious to everyone who chooses to consider the statistics of the case." Chambers of Commerce and other commercial organizations now fell in behind the idea, and in 1872 President Grant urged Congress to insure that the West and South had adequate transportation for their increasing products. In 1874 the Corps submitted to Congress further estimates and details of surveys, which did not differ materially from Craighill's. But if the proposal ever had a chance with Congress, the Panic of 1873, which turned the great postwar economic boom into despairing depression, ended any such possibility. By the end of the decade the James River and Kanawha Canal became another abandoned enterprise.

THE END OF THE CANAL-BUILDING ERA

By 1840 the great period of canal construction was over. Work continued on the Chesapeake and Ohio and on the James River and Kanawha canals; and the Union, Morris, and Delaware and Hudson canals were enlarged and improved. But no new construction on canals of major size was started, and by the 1850s abandonment of canal mileage exceeded new building. High construction costs, heavy fixed charges, and less than expected revenues contributed to the collapse of the canal-building boom, but they do not appear to have been vital causes. Railroads, whose construction costs seem to have averaged higher than those for canals, also had their share of financial difficulties, yet investment in them continued, and for a time most canals were profitable ventures. Pennsylvania in the East and Indiana in the West became disastrously involved in the enthusiasm for canal building, but their experiences were not typical. The financial crises of 1837 and 1839 perhaps retarded construction.

But canal building came to an end primarily because by 1840 most of the practicable routes for long-distance artificial waterways had been developed and by that year the enormous potential of the railroad could no longer be doubted.⁴¹

In September 1825, one month before the Erie Canal opened to through traffic, George Stephenson ran his pioneer locomotive over the Stockton and Darlington Railroad line in England. The steam engine promised a future for railroads that early horse-drawn systems, which were little more than turnpikes with tracks, could never have achieved. Interest in railroads immediately spread to the United States. Numerous corporations, starting with the Baltimore and Ohio Railroad Company in 1827, began constructing roads on the eastern seaboard. The first trial of an American-made steam locomotive took place in August 1830. The early railroads were crude affairs, but they were rapidly improved, and they completed the transportation revolution in the United States that had begun with the construction of turnpikes. Less obliged than canals to conform to the lay of the land, not freezing up for part of the year, unaffected by droughts and seldom by floods, easier to connect with the point of origin and the ultimate destination of goods, and carrying freight at the prodigious speed of 20 miles an hour, railroads possessed advantages that few canals of the time, even those capable of handling heavy traffic, could hope to overcome. Many canals, especially those that carried coal, continued to be relatively prosperous well into the second half of the nineteenth century. Some did not reach their peak traffic until after the Civil War, but eventually railroad competition forced their abandonment.

Though the Canal Era was brief, it greatly furthered the transportation revolution in the United States that permitted a huge expansion of agriculture and industry in the decades before the Civil War. The waterways opened new areas to profitable use and stimulated economic development everywhere they serviced. Even those that failed to pay a fair return on investment were almost always useful to the public, even if not profitable to their owners.